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ARTICLE

Bioanthropological analysis of Békés 103 (Jégvermi-kert, Lipcsei-tanya), a Bronze Age cemetery from southeastern Hungary

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ABSTRACT The analysis of human skeletal remains is an important tool for reconstructing aspects of health, diet, disease, and population structure (such as demographics, life expectancy, and mortality) in past populations. This study presents the recovery techniques and initial bioanthropological analysis of cremation and inhumation burials from the archaeological site of Békés 103, a Bronze Age cemetery located in southeastern Hungary. In all possible cases, analysts microexcavated cremation urns in a laboratory setting to ensure recovery of all fragmentary skeletal material and allow detailed spatial documentation of each burial's contents. This report presents estimated age and sex information for each individual, provides a preliminary assessment of observable trends in the population, and offers a paleodemographic profile of the cemetery for comparison with contemporary prehistoric communities in Hungary.
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KEY WORDS

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Introduction

Despite a long history of archaeological research in the Lower Körös Basin (Körös-vidék) of southeastern Hungary, we know little about the mortuary practices and population structure of people living there during the Bronze Age (2700-900 cal BC). This absence is finally being corrected through fieldwork at the Békés 103 (Jégvermi-kert, Lipcsei-tanya) site, and analysis by the Bronze Age Körös Off-Tell Archaeology (BAKOTA) project reported here provides a first account of the mortuary and biological characteristics of the population in this region. The recovered skeletal material is primarily cremation, and though comparison with other cremation traditions would be ideal, there are no detailed publications of bioanthropological data for cremation cemeteries nearby. In this report, we therefore present age and sex data for all excavated burials to date, offer a paleodemographic profile for the cemetery during the most intensive 300 years of use, and provide a comparison of the burial and demographic patterns with data from two neighbouring culture groups, the Maros and Füzesabony.

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Archaeological background

The Békés 103 (Jégvermi-kert, Lipcsei-tanya) site is situated in the Lower Körös Basin on an ancient meander of the Kettős-Körös River, near the modern town of Békés (Fig. 1). Hungarian archaeologists discovered the multicomponent site through systematic field walking surveys in the 1990s, and discovery of burned human bone and Bronze Age urn fragments in the early 2000s revealed that the area had been used as a cemetery (Duffy et al. 2014).

The BAKOTA project carried out archaeological fieldwork at the Békés 103 site between 2011 and 2015. Over four field seasons, excavation revealed human remains in 67 of the 68 identified human burial (HB) features, and cremation of human bones makes up the dominant body treatment (91.2% of burials). In fifty-eight cases, mourners placed the cremains in a ceramic funerary urn (Fig. 2), but in two occasions practiced scattered cremation (Fig. 2). Five graves contained inhumations (Fig. 2), and in three cases, the precise burial rite was unclear, though two of these contained cremated human bone.

Our stylistic analysis and radiocarbon dating of the burials at Békés 103 suggest ancient people used the site as a burial ground from the Early to Late Bronze Age. However, the majority of the graves fall within a much narrower timeframe,

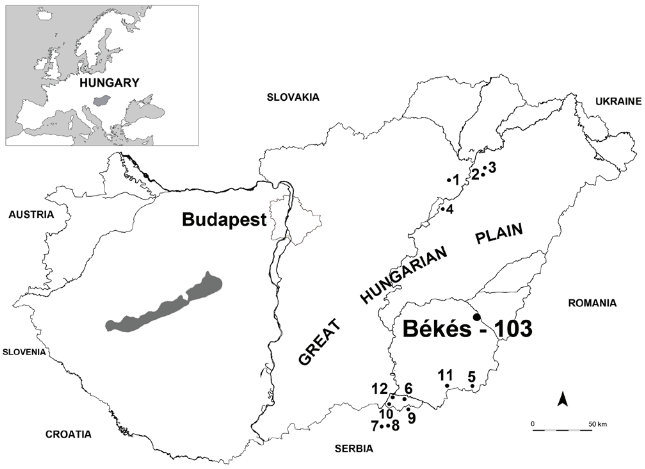

Figure 1. The geographical location of the Bronze Age Békés 103 site and Bronze Age sites used for comparison (Füzesabony group: Gelej-Kanális-dűlő (1), Polgár-Homok-dűlő (2), Polgár-Kenderföldek - Majoros-tanya (3), Tiszafüred - Majoroshalom B, D (4); Maros group: Battonya-Vörös Október TSZ (5), Deszk A,F, (6), Mokrin (7), Ostojicevo (8), Óbéba (9), Ószentiván (10), Pitvaros (11), Szőreg C (12).

between 1600 and 1300 cal BC. Most researchers generally consider this time range to represent the final centuries of the Middle Bronze Age (2000 and 1450 cal BC) and the early phase of the Late Bronze Age in the Carpathian Basin (Fischl et al. 2013; Fischl et al. 2015; Kiss et al. 2015).

The culture groups used for comparison to the population of Békés 103 overlap in time with some, but not all, of the cemetery's period of most intensive use (O'Shea 1996; O'Shea et al. 2011; Fischl et al. 2013; Fischl et al. 2015). In contrast with the Békés 103 population, both the Maros and Füzesabony groups practiced inhumation as a normative body treatment (O'Shea 1996; Csányi 2003), though cremation becomes common in the later phase of Füzesabony (Polla 1960; Fischl 1999). Yet these groups still serve as the best points of comparison with the Körös Basin cemetery. Like the community at Békés 103, Maros and Füzesabony groups also inhabited the Eastern Carpathian Basin during the Middle Bronze Age (see Fig. 1 for site locations referenced in this study), and all three groups share common ceramic styles (such as the swedish helmet bowl), technological traditions (Kreiter 2005), and settlement structures (Bóna 1993). Despite the cultural and temporal differences, therefore, these two groups will serve as a first line of comparison to highlight obvious digressions in mortuary behaviour and demography.

Methods

Microexcavation

Field workers excavated inhumations and scattered cremations in situ, and photographed and mapped all burials in the field during excavation, but we transported cremations in funerary urns to the lab to be carefully microexcavated in a controlled setting. Where possible, we used layer-by-layer microstratigraphic excavations to recover fragmentary skeletal material, but where natural stratigraphy was absent, we removed urn fill in arbitrary 2-4 cm levels. We photographed each level and recorded observations about that levels' characteristics on a detailed profile map (Fig. 3). This included descriptions of the colour and texture of the urn fill for each context, approximate thickness of the layer, the presence of non-skeletal material, and the location of samples taken for further analysis (such as ancient DNA and isotopic analysis). When visible, excavators recorded the position and direction of fragments or bone clusters, the spatial distribution of the bones by anatomical regions, and morphological or metric data indicative of the individual's age at death or sex. We also noted preliminary observations about heat-related color and/or fracture changes due to the cremation process, and pathological alterations with their possible etiology. We assigned a discrete identification number to bones from each

Figure 2. Body treatment at the Békés 103 cemetery: urn cremation (HB 06) (a), scattered cremation (HB 04) (b), inhumation (HB 03) (c). Photo credits: Paul R. Duffy.

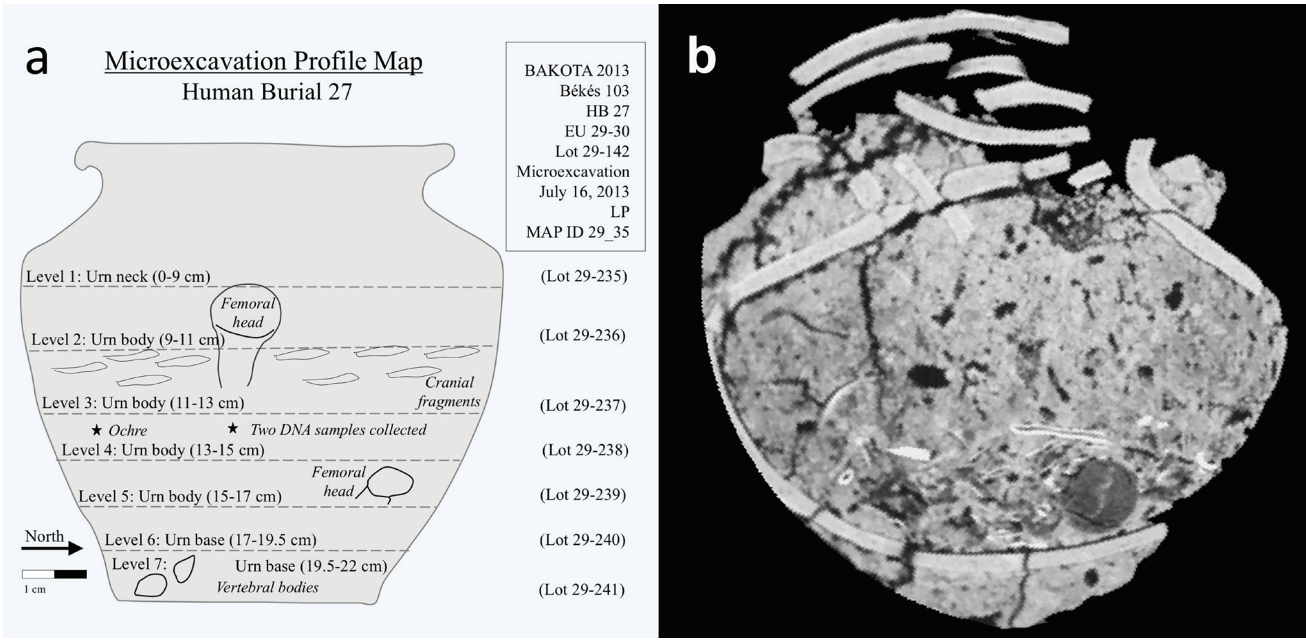

Figure 3. Digitized and simplified microexcavation profile map of HB 27 (a). CT image of HB 27 showing a measurable femoral head (dark grey circle on bottom right) (b).

level, and then washed, counted, and weighed them according to context to maintain the spatial resolution of the dataset for future analyses.

Computed tomography

We scanned ten cremation urns prior to microexcavation using computed tomography (CT). Scans were conducted on a GE Lightspeed unit, using a 140 kV at 400 mA exposure with a slice thickness of 0.625 mm. The scans provided a non-destructive technique to explore the internal composition of the urns prior to the removal of the burial contents, and CT images were useful for documenting the position, density, and relative stratigraphy of skeletal material and artifacts within the urn (Fig. 3). In a few cases, we used these images to measure critical elements of intact bones before removal (such as the diameter of a delicate unfused femoral head of a Juvenis individual featured in Fig. 3), improving chances of assigning age at death.

Age and sex estimation

We estimated age at death for subadult individuals using known patterns of bone growth and development, including morphological and metric characteristics of juvenile bones (Fazekas and Kósa 1978; Stloukal and Hanáková 1978 Schaefer, Black and Scheuer 2009), and the sequence of tooth formation and eruption (Ubelaker 1989; Smith 1991). Our analysis estimated adult age based on morphological changes in the pubic symphysis (Suchey and Katz 1998), and age-dependent changes in rib and clavicle ends (Loth and Iscan 1989). We categorized the results of the age estimation using Martin's classification (Martin and Saller 1957). In cases, where poor preservation or the incompleteness of skeletal material prevented attribution to a Martin classification, we used intermediate (*e.g.*, Inf I - Inf II) or even broader categories (*e.g.*, subadult, adult) (see Results).

The biological sex of adults was based on anatomical sites/areas showing sexual differences. Using metric and non-metric characteristics of both the skull and postcranial skeleton, we scored twelve and nine anatomical areas, respectively (Éry et al. 1963). We characterized individuals as "indeterminate" in cases where no age or sex-related morphological or developmental traits were observable.

Life expectancy and mortality calculations

We used physiological age determinations to estimate life expectancies and mortality characteristics for the population. Life tables allow calculation of survival probability in a population for a given age category, which can then be used for comparison to other populations or modeling of living population size (Acsádi and Nemeskéri 1970). This calculation makes several assumptions (*i.e.* the population is stable, that death rates are uniformly distributed across age and sex categories, and that the archaeological population accurately

Table 1. Determination of age at death, sex, and number of individuals in each human burial. Key: Burial no: HB (human burial); Body treatment: UC (urn cremation), SC (scattered cremation), I (inhumation); Age: age in weeks refers to prenatal life; Sex: M (male), F (female), I (indeterminate sex).

Burial no.	Treatment	Age category	Age	Sex	Burial no.	Treatment	Age category	Age	Sex
HB 01	UC	Juvenis	13-18 ys	I	HB 34	UC	Infant II	6-12 ys	I
HB 02	UC	adult	20-x	M?	HB 35	UC	Inf I - Inf II	1-12 ys	I
HB 03	I	Juvenis	12-14 ys	F?	HB 36	UC	Infant II	6-8 ys	I
HB 03	I	foetus/newborn	week 40	I	HB 37	UC	adult	20-25 ys	F
HB 04	SC	adult	20-x ys	I	HB 38	UC	Inf I - Inf II	1-12 ys	I
HB 05	UC	indeterminate	-	I	HB 39	UC	subadult	1-19 ys	I
HB 06	UC	adult	20-x ys	F	HB 40	UC	adult	20-x ys	M
HB 07	UC	adult	20-x ys	I	HB 41	UC	Adultus	25-39 ys	F
HB 08	UC	Adultus	21-25 ys	F	HB 42	UC	Infant I	2-3 ys	I
HB 08	UC	Infant I	1-6 ys	I	HB 43	I	Infant I	0-0.5 ys	I
HB 09	UC	Adultus	20-40 ys	F	HB 44	I	foetus/newborn	week 32-36	I
HB 10	UC	Ad-Mat	30-49 ys	F?	HB 45	UC	adult	20-x ys	M
HB 11	UC	Infant I	2-6 ys	I	HB 46	UC	adult	20-x ys	M
HB 12	UC	subadult	0-19 ys	I	HB 47	UC	Ad-Mat	35-50 ys	F
HB 13	UC	foetus/newborn	week 36-40	I	HB 48	UC	Adultus	25-39 ys	F
HB 14	UC	Infant I	3-5 ys	I	HB 49	UC	adult	20-x ys	I
HB 14	UC	Adultus	20-25 ys	I	HB 50	UC	Inf I - Inf II	1-12 ys	I
HB 15	UC	Infant I	4-6 ys	I	HB 51	unknown	indeterminate	-	I
HB 15	UC	adult	20-x ys	I	HB 52	I	foetus/newborn	week 38	I
HB 16	UC	adult	20-x ys	I	HB 53	UC	adult	20-x	I
HB 17	UC	Juvenis	16-20 ys	F?	HB 54	UC	adult	20-x ys	M
HB 18	UC	Infant I	1-3 ys	I	HB 55	SC	Infant I	1-2 ys	I
HB 18	UC	adult	20-x ys	F	HB 56	UC or SC	Inf I - Inf II	1-12 ys	I
HB 19	UC	indeterminate	-	I	HB 57	UC	Inf I - Inf II	1-12 ys	I
HB 20	UC	Adultus	30-40 ys	I	HB 58	UC	subadult	1-19 ys	I
HB 21	UC	adult	20-x	F	HB 59	I	Infant I	1-6 ys	I
HB 22	UC	Infant II	6-12 ys	I	HB 60	UC	Ad-Mat	35-50 ys	I
HB 23	UC	Infant I	1-6 ys	I	HB 61	UC	Infant I	1-6 ys	I
HB 24	UC	Adultus	20-24 ys	I	HB 62	UC	Maturus	40-59 ys	F
HB 25	unknown	no remains	-	-	HB 62	UC	foetus/newborn	week 30-32	I
HB 26	UC	Infant I	1-3 ys	I	HB 63	UC	Inf I - Inf II	1-12 ys	I
HB 27	UC	Juvenis	13-19 ys	I	HB 64	UC	Infant I	1-6 ys	I
HB 28	UC	Adultus	25-35 ys	F	HB 65	UC	Infant I	1-6 ys	I
HB 29	UC	adult	20-x ys	I	HB 66	UC	Maturus	40-59 ys	M
HB 30	UC	adult	20-x ys	I	HB 66	UC	Inf II - Juv	6-19 ys	I
HB 31	UC	Infant II	6-12 ys	I	HB 67	UC	adult	20-x ys	I
HB 32	same as HB 39				HB 68	UC	indeterminate	-	I
HB 33	UC	indeterminate	-	I	HB 69	UC	adult	20-x ys	F

represents the true biological population). In this study, the cemetery population spans several generations, which makes the assumption of stationarity a reasonable one to make (Sattenspiel and Harpending 1983). In every possible case, we carefully microexcavated the cremation urns in the lab ensuring recovery of very small skeletal remains (easily missed or misidentified in field settings). Life expectancy values were calculated using Bernert's (2005) anthropological programme pack, based on Acsádi and Nemeskéri (1970). Due to the difficulty of making sex determinations on cremated bone, we excluded sex data from our estimation of life expectancy, and assumed a balanced distribution of sexes among adults. By convention, the highest estimated age within a cemetery is used as a maximum lifespan for that cemetery, so in calculating life expectancy at Békés 103, we used 60 years as the maximum lifespan (Table 1). This baseline lifespan maximum obviously has implications for comparing cemeteries with greatly different sample sizes or different body treatments, where cultural practices (such as cremation) preclude confident identification of much older individuals. We address these concerns in the discussion.

It is also important to note that, according to radiocarbon dates and a preliminary stylistic analysis of the ceramics, six of the 67 human burials with human remains belong to chronological periods earlier or later than the majority of the cemetery's population. For this reason, we exclude the individuals in these burials (HB 21, HB 54, HB 55, HB 57, HB 59, and HB 62) from the paleodemographic analysis in order to ensure a representative population for the timeframe between 1600 and 1300 cal BC.

Results

We analysed human bone fragments from 67 graves and identified skeletal remains for 74 individuals (Table 1).

Estimated number of individuals

Ninety percent of the graves contained bone fragments belonging to a single person, but in the case of one inhumation (HB 03) and six urn cremations (HB 08, HB 14, HB 15, HB 18, HB 62, and HB 66) we identified two individuals (an adult and a subadult in a majority of cases) during the osteological analysis. In most cases, a single ceramic vessel included the bones of both individuals; the second person's remains formed single or multiple clusters of bones within the osseous matrix of the first individual. However, HB 08 represents another type of double burial. In this case, the mourners placed two adjoining cremation urns in a single pit. Interestingly, both vessels included fragments of both individuals, but one of the urns contained mostly adult bone fragments, while the other vessels contained a majority of subadult pieces. In two other urns, we identified a single fragment of another individual included with the primary skeletal contents. In these cases, it was not possible to determine the age/sex of the extra skeletal material or even whether the burial was an intentional double burial. We therefore did not count these remains as separate individuals at this stage of the analysis. Future investigations will explore whether patterns of single bone inclusions reflect actual mortuary practices or simply secondary byproducts of some other behavior. HB 03 is the only inhumation that included skeletal remains of two individuals: a fairly well preserved 12-14 year old and fragments of a foetus/newborn.

Three burials (HB 19, HB 25, HB 32) require further explanation with respect to identification of individuals in the cemetery. In the case of HB 19, we collected a few bones during excavation, but most remains were left unexcavated because we identified the burial at the edge of a profile wall that extended into a contemporary road, making extension of the excavation unit impossible. Our conservative preliminary estimate is that this burial represents a single individual. We identified HB 25 by the base of a small vessel usually included as a grave good along with a cremation urn or an inhumation; however, the area around the vessel was highly disturbed and no human remains were found during the excavation. While this feature may represent a burial of some kind regardless of the presence of skeletal material (*e.g.*, symbolic), due to preservation, we cannot be sure an individual was included. Finally, we initially designated HB 32 as a distinct, and highly disturbed, cremation urn burial located next to another burial, HB 39. Analysis of the skeletal and ceramic data post-excavation revealed that the remains were from the same burial, so we combined the remains for further analysis under the designation HB 39.

Paleodemographic profile

The following estimates of population structure exclude six chronological outlier graves (and seven individuals), and include only the 61 burials (and 67 individuals) that were buried at the site between 1600 and 1300 cal BC. From these we could determine the age for 62 individuals. Concerning the distribution of age at death, subadults and adults are balanced with 29 and 33 people belonging to these broad age categories, respectively (Fig. 4). All of the subadult age categories are present, but the Infant I category is the most represented (12/33). The adultus age category (20-39 years) is the most represented sub-category among adults (8/29). The prevalence of individuals in older age categories decreases with age, though we were not able to determine the precise age of 17 adults.

Determination of biological sex is difficult in cremated human remains due to fragmentation and the absence of diagnostic morphological characteristics. In this sample, we were able to determine the biological sex in 48.3% of adults, if we also include likely sex designations (*i.e.* M?). We identified ten females and four males (Fig. 4).

The table below illustrates the calculated life expectancy for the Békés 103 cemetery at different age intervals assuming a maximum life span of 60 years. Life expectancy at birth was 21.88 years, while those who survived to early adulthood (20-24 years) were expected to live another 17.47 years (Table 2).

We assumed a balanced sex ratio and did not calculate mortality curves by sex due to the fragmentary nature of the cremated remains and the limited number of sex determinations. The cemetery's mortality profile has three peaks (Fig. 5). The highest and most characteristic one appears between 1 and 4 years of age, and it is followed by a rapid, monotonic decline to a low point at around 15-19 years of age. The second peak is at early adulthood (20-24 years), while a less pronounced peak is also recognizable between 35-39 years of age. The mortality curve presents a slow decline at older age categories, but the decline is not monotonic.

Discussion and Conclusion

The bioanthropological analysis of the Békés 103 cemetery provides the first dataset of its kind for the Lower Körös

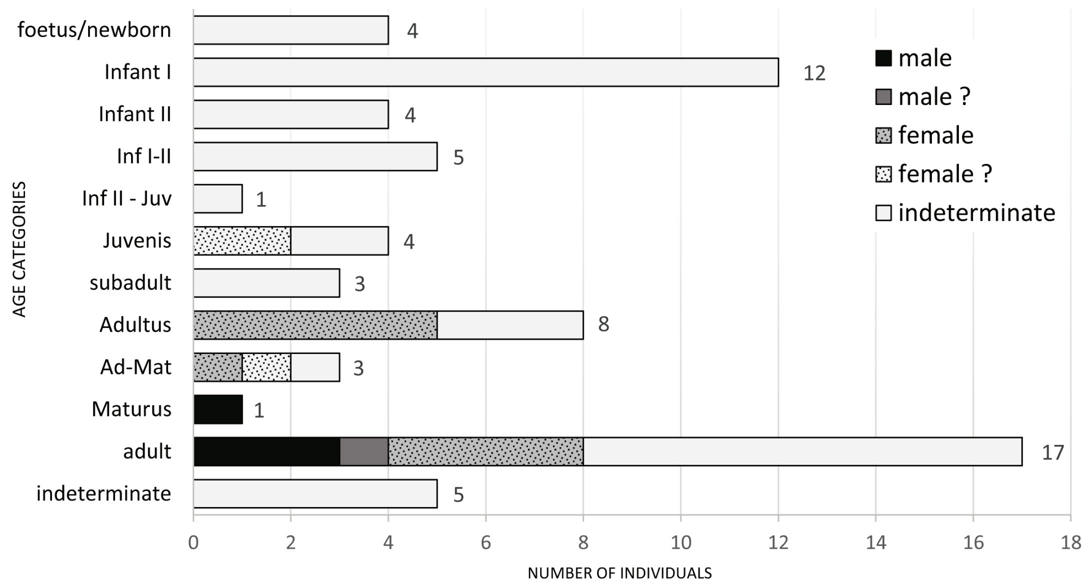

Figure 4. Distribution of age at death and biological sex in the Békés 103 cemetery.

Basin in southeastern Hungary. Below, we offer preliminary comparisons to previously published skeletal collections found in the Maros and Füzesabony Bronze Age cultural traditions from the eastern Carpathian Basin (for site locations mentioned in the text, see Fig. 1).

Seven burials from this study contained the remains of more than one individual. The majority of these burials included an adult (both males and females were identified) and the remains of a subadult under age six. Exceptions include one cremation urn (HB 66) that contained bones of an adult and an Infant II-Juvenis (6-19 years), and an inhumation (HB 03) that contained the skeletal remains of a subadult (12-14 years old) and a foetus-newborn.

Burying multiple individuals in a single grave is not uncommon during the Bronze Age in the eastern Carpathian Basin, but researchers identified only a few cases in cemeteries from Maros and Füzesabony groups (Hajdu 2012; O'Shea 1996). These cases include the Mokrin and Szőreg C cemeteries in the Maros area, where both male and female adults are buried with subadults, both infants and children (O'Shea 1996). The relationship between the individuals in double burials is not known, though parent/child relationships, and expedient practical parameters (for example, similar timing of death) may be responsible for the pairing. Reports from Füzesabony cemeteries Polgár-Kenderföldek-Majoros-tanya, Tiszafüred-Majoroshalom (B, D), and Gelej-Kanális-dűlő, Polgár-Homok-dűlő, note burials with multiple individuals with a wider variety of age combinations (subadult-subadult, subadult-adult, and adult-adult combinations) and a diverse sex distribution among them (Hajdu 2012; Zoffmann 2006).

Table 2. Life table of the Békés 103 cemetery (estimated maximum life span = 60 years). Dx: death's no, dx: percentage of deaths, lx: survivors entering, qx: probability of death, Lx: total years lived between x and x + 5, Tx: total years after lifetime, ex: life expectancy.

Age groups	Dx	dx	lx	qx	Lx	Tx	ex
0	4,0	5,97	100,00	0,04	97,01	2188,08	21,88
1-4	11,6	17,26	94,03	0,12	341,60	2091,07	22,24
5-9	9,4	13,96	76,77	0,12	348,93	1749,47	22,79
10-14	5,7	8,53	62,80	0,09	292,69	1400,54	22,30
15-19	3,7	5,59	54,27	0,07	257,38	1107,85	20,41
20-24	6,3	9,37	48,68	0,13	219,99	850,47	17,47
25-29	4,3	6,36	39,31	0,11	180,67	630,48	16,04
30-34	4,4	6,62	32,95	0,13	148,21	449,81	13,65
35-39	4,7	7,01	26,33	0,18	114,14	301,61	11,45
40-44	3,6	5,42	19,32	0,19	83,05	187,47	9,70
45-49	3,5	5,22	13,90	0,25	56,45	104,41	7,51
50-54	2,7	4,10	8,68	0,32	33,16	47,97	5,53
55-59	2,6	3,91	4,58	0,57	13,13	14,81	3,23
60-64	0,4	0,67	0,67	0,67	1,68	1,68	2,50
65-69	0,0	0,00	0,00	0,00	0,00	0,00	0,00
70-74	0,0	0,00	0,00	0,00	0,00	0,00	0,00
75-79	0,0	0,00	0,00	0,00	0,00	0,00	0,00
80-84	0,0	0,00	0,00	0,00	0,00	0,00	0,00
85-89	0,0	0,00	0,00	0,00	0,00	0,00	0,00
90-94	0,0	0,00	0,00	0,00	0,00	0,00	0,00
95-99	0,0	0,00	0,00	0,00	0,00	0,00	0,00
Total	67,0	100,00					

The age distribution of the Békés 103 cemetery is similar to Füzesabony group cemeteries in that all age categories can be found there (Zoffmann 2006, 2011; Hajdu 2012). This

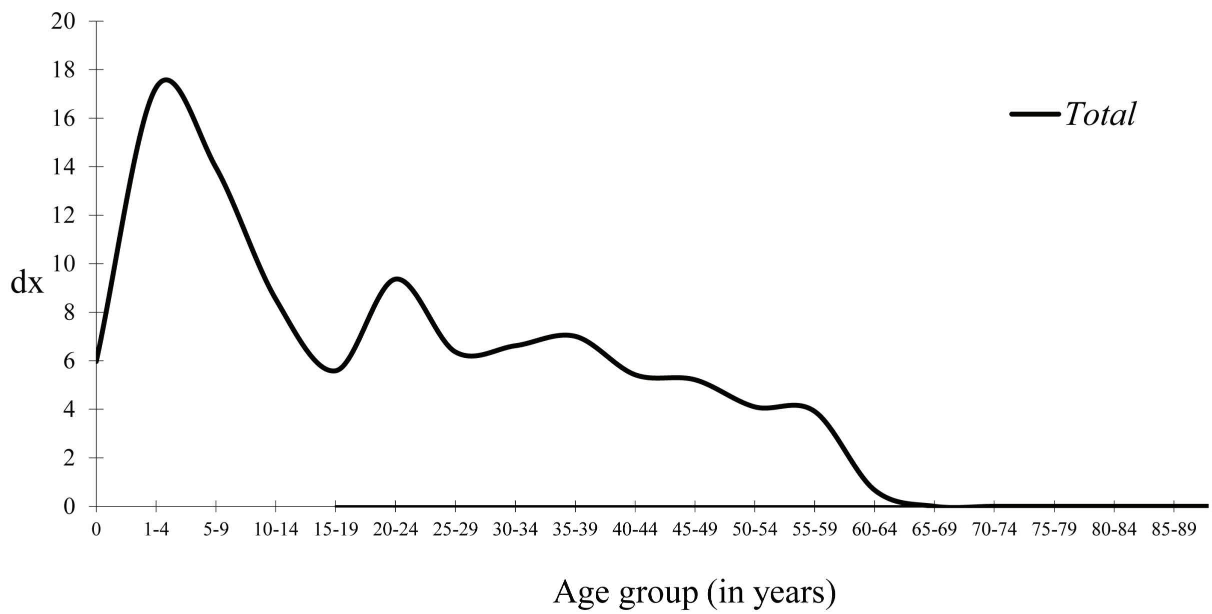

Figure 5. Mortality profile of the population of Békés 103 cemetery (estimated maximum life span = 60 years).

varies from what has been documented at most Maros cemeteries (*e.g.*, Deszk A, Deszk F, Mokrin, Őszentiván, Óbéba, Pitvaros), where young infants under three years of age are missing from the cemetery population. This absence suggests an alternate funerary custom for the very young, and settlement excavation has identified infant burial (O'Shea 1996). Subadult grave pits are significantly shallower than adults at Deszk F, Mokrin, Pitvaros and Szőreg C however, so taphonomic processes such as erosion cannot be excluded as the source of missing very young individuals (O'Shea 1996). For this reason, the cemetery of Ostojićevo is rare in the Maros for containing the full range of age categories (Zoffmann 2006, 2011; Hajdu 2012).

Accurately determining biological sex in a mostly cremated sample is difficult due to the fragmentary nature of burned human bone, so the cremains from Békés 103 include a relatively small number of positive identifications. Nonetheless, the sex data for adults in the cemetery are quite disproportionate, with females more than doubling the number of identified males. It is worth noting that an imbalanced sex distribution is common from several nearby Bronze Age cemeteries of the Maros (*e.g.*, Deszk A, Mokrin, Őszentiván, Szőreg) and Füzesabony (Gelej-Kanális-dűlő, Polgár-Kenderföldek-Majoros-tanya) (Farkas and Lipták 1971; Farkas 1975; O'Shea 1996; Zoffmann 2006, 2011; Hajdu 2012). The cause of the distribution is not known, though O'Shea suggests that the participation of males in warfare away from home plausibly accounts for it (O'Shea 1996). While it is interesting that we also found a female predominance in our sample, a larger sample size would be needed to demonstrate its significance.

We present the calculated life expectancy at birth for Békés 103 alongside published Maros and Füzesabony values in Figure 6. Though Békés 103 is the lowest of the bunch, there are two important factors influencing this pattern. First, because identification of older individuals at Békés 103 is difficult due to the cremation, the upper age limit used for the cemetery (60 years) may be more an artifact of sample size and the vagaries of the cremains than the actual maximum age of the population, though older individuals are sometimes identified in cremation cemeteries of similar sample size (Zoffmann 2011). At inhumation cemeteries, however, individuals are routinely identified as 70 or 75 years of age, and setting the age maximum 10-15 years higher at Békés 103 would raise the life expectancy at birth by 2-3 years. Second, most of the inhumation cemeteries in the Maros areas lack the youngest individuals (see above), resulting in higher life expectancies at birth than normal. Without correction by addition of infants to the dataset, these values are not directly comparable to populations with young individuals present (for an example of a correction, see O'Shea 1996). Besides these methodological factors, diet, pathological conditions, and way of life could also affect life expectancy. In the future, correction of datasets missing young infants, and inclusion of cremation cemeteries with similar age maximums, will allow meaningful comparison of life expectancies at birth. As it currently stands in Figure 6, it is clear that the life expectancy values of Maros cemeteries are higher than values at Füzesa-

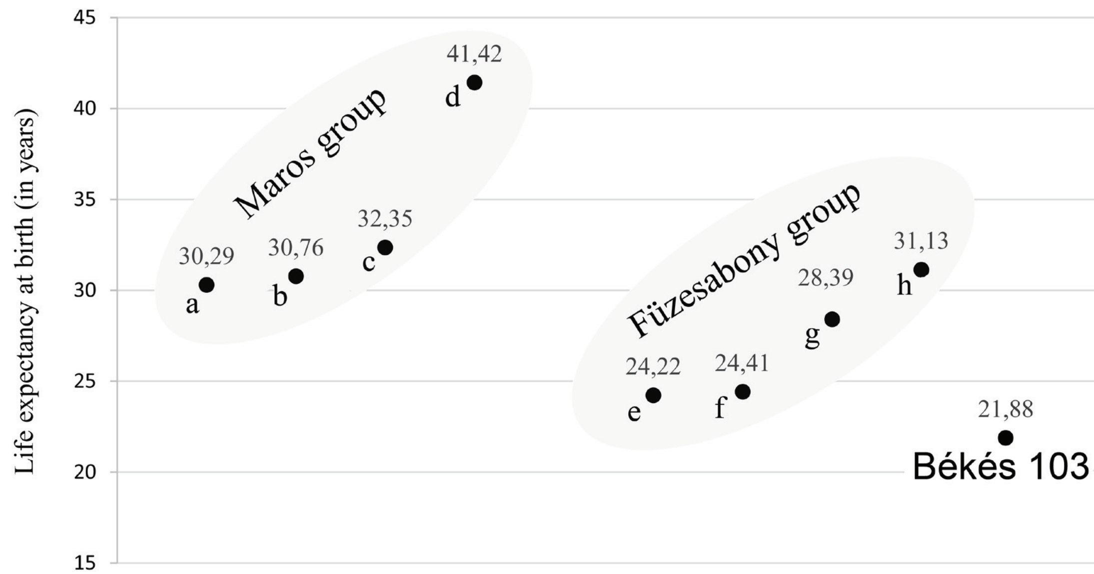

Figure 6. Life expectancy at birth values from Bronze Age cemeteries. Maros group: Battonya-Vörös Október TSZ (Zoffmann 2011) (a), Ostojicevo (Zoffmann 2011) (b), Mokrin (Zoffmann 2011) (c), Szőreg C (Zoffmann 2011) (d). Füzesabony group: Polgár- Kenderföldek - Majoros-tanya (Zoffmann 2011) (e), Tiszafüred - Majoroshalom B, D (Hajdu 2012) (f), Gelej-Kanális-dűlő (Hajdu 2012) (g), Polgár-Homok-dűlő (Zoffmann 2011) (h).

bony sites and Békés 103 because the youngest individuals in the population are not present in the cemeteries at the former, but are present in the latter.

Researchers identify a U-shaped pattern of age-specific mortality across a wide range of human populations, indicating the highest mortality for the very young and old (Wood et al. 2002). Our sample only partially fits this profile. The high mortality values in the first few years of life in the Békés 103 sample might be associated with higher susceptibility to factors such as infections or other pathological conditions. This is a typical trend found in prehistoric populations, and consistent with naturally-occurring biological expectations (Rega 1997; Hoppa 2002). Our sample lacks the second high mortality peak for the older age category characteristic of most human populations. It is very difficult or impossible to identify subtle age related changes in the cremated bone of older individuals, possibly making the right end of the mortality profile misleading. A larger dataset may help clarify whether this pattern actually reflects some biological reality, or simply the limitations of our dataset.

Summarizing our results, we can say that the basic paleodemographic data provided by classical bioanthropological methods and medical imaging techniques give us useful information for the Bronze Age Békés 103 cemetery's population structure. The preliminary results of Bronze Age skeletal material at Békés 103 provide both similarities and contrasts with other Bronze Age populations, and offer several avenues for future explorations. These data form part of several ongoing BAKOTA research projects focused on understanding mortuary customs at the Békés 103 site. Future studies will also incorporate these data into the analysis of bone weight, heat-related color and fracture changes, the spatial distribution of bones in urns, the chemical composition of bone and ceramics, and the stylistic and spatial characteristics of associated grave goods.

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References

Acsádi G, Nemeskéri J (1970) History of Human Life Span and Mortality. Akadémiai Kiadó, Budapest.

Bernert Z (2005) Paleoantropológiai programcsomag. Folia Anthropol 3:71-74.

Bóna I (1994). Les cultures des tells de l'age du bronze en Hongrie. In Bóna I, Raczky P, eds., Le Bel Âge du Bronze en Hongrie. Centre Européen d'Archéologie du Mont-Beuvray, Mont Beuvray, 9-39.

Csányi M (2003) Cemeteries of the Füzesabony Culture. In Visy Z, Nagy M, Kiss BZ, eds., Hungarian Archaeology at the Turn of the Millenium. Ministry of National Cultural Heritage, Teleki László Foundation, Budapest, 157-158.

Duffy PR, Parditka Gy, Giblin JI, Paja L, Salisbury RB (2014) Discovering Mortuary Practices in the Körös River Basin, Hungary. Available: http://www.hungarianarchaeology.hu/wp-content/uploads/2014/11/eng_duffy_14O.pdf. Accessed: 12 December 2016.

Éry K, Kralovánszky A, Nemeskéri J (1963) Történeti népességek rekonstrukciójának reprezentációja (A representative reconstruction of historic population). Anthropol Közl 7:41-90.

Farkas G (1975) A Dél-Alföld őskorának paleoantropológiája (Palaeoanthropology of the Southern Great Hungarian Plain's Prehistory). C.Sc. Dissertation. József Attila University, Szeged, Hungary.

Farkas G, Lipták P (1971) Antropološko istraživanje nekropole u Mokrinu iz ranog bronzanog doba (Physical anthropological examination of a cemetery in Mokrin from the Early Bronze Age). In Giric M, ed., Mokrin, nekropola ranog bronzanog doba. Dissertationes et Monographie 11:239-271.

Fazekas IG, Kósa F (1978) Forensic Fetal Osteology. Akadémiai Kiadó, Budapest.

Fischl PK (1999) Mártély-Szegfű. A Perjámos-kultúra szerepe a Dél-Alföld vegyes rítusú temetőiben. Mártély-Szegfű. Die Rolle der Perjamos-Kultur in den Gräberfeldern mit gemischtem Ritus an der Grossen Ungarishen Tiefebene. Savaria 24/3, 215-237.

Fischl PK, Kiss V, Kulcsár G, Szeverényi V (2015) Old and new narratives for Hungary around 2200 BC. In Meller H, Arz HW, Jung R, Risch R, eds., 2200 BC-A climatic breakdown as a cause for the collapse of the old world? Tagungen des Landesmuseums für Vorgeschichte Halle, 12/II. Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Landesmuseum für Vorgeschichte, Halle, 503-523.

Fischl PK, Kiss V, Kulcsár G, Szeverényi V (2013) Transformations in the Carpathian Basin around 1600 B. C. In Meller H, Bertemes F, Bork HR, Risch R, eds., 1600-Cultural change in the shadow of the Thera-Eruption? Tagungen des Landesmuseums für Vorgeschichte Halle, 9. Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt-Landesmuseum für Vorgeschichte, Halle, 355-372.

Hajdu T (2012) A bronzkori füzesabony- és halomsíros kultúra népességének biológiai rekonstrukciója (Biological reconstruction of the Bronze Age Füzesabony- and Tumulus Grave culture populations). Ph.D Thesis. Eötvös Loránd University, Budapest.

Hoppa RD (2002) Paleodemography: Looking Back And Thinking Ahead. In Hoppa RD, Vaupel JW, eds., Paleodemography: Age Distributions From Skeletal Samples. Cambridge Studies In Biological And Evolutionary Anthropology 31. Cambridge University Press, Cambridge, 9-28.

Kreiter A (2005) Technological Choices and Material Meanings: analyses of Early and Middle Bronze Age ceramics from Hungary. Ph.D thesis, University of Southampton, Southampton.

Kiss V, Fábián S, Hajdu T, Köhler K, Kulcsár G, Major I, Szabó G (2015) Contributions to the Relative and Absolute Chronology of the Early and Middle Bronze Age in Western Hungary Based on Radiocarbon Dating of Human Bones. In Németh ER, Rezi B, eds., Bronze Age Chronology in the Carpathian Basin. Proceedings of the International Colloquium from Târgu Mureş, 2-4 October 2014, Bibliotheca Musei Marisiensis, Seria Archaeologica VIII, Târgu Mureş, 23-36.

Loth S, Iscan MY (1989) Morphological assessment of age in the adult: the thoracic region. In Iscan MY, ed., Age markers in the human skeleton. Charles C. Thomas, Springfield. 105-135.

Martin R, Saller K (1957) Lehrbuch der Antropologie I-II. Fischer Verlag, Stuttgart.

O'Shea JM (1996) Villagers of the Maros. A Portrait of an Early Bronze Age Society. Interdisciplinary Contributions to Archaeology, Springer Science + Business Media, New York.

O'Shea JM, Barker A, Motta L, Szentmiklosi A (2011) Archaeological investigations at Pecica „Şanţul Mare" 2006-2009. Analele Banatului: Arheologie-Istorie, 19, 67-78.

Polla B (1960) Birituelle Füzesabonyer Begräbnisstätte in Streda nad Bodrogom. In Chropovsky B, Dusek M, Polla, eds., Gräberfelder aus der älteren Bronzezeit in der Slowakei. I Hrg., Tocik, A. ArchSlovFontes 3. Bratislava, 299-385.

Rega E (1997) Age, Gender and Biological Reality in the Early Bronze Age Cemetery at Mokrin. In Moore J, Scott E, eds., Invisible People and Processes: Writing Gender and Childhood into European Archaeology, Leicester University Press, Leicester, 229-247.

Sattenspiel L, Harpending H (1983) Stable populations and skeletal age. Amer Antiq 48, 489-498.

Schaefer M, Black S, Scheuer S (2009) Juvenile Osteology: A Laboratory and Field Manual. Academic Press, San Diego.

Smith BH (1991) Standards of human tooth formation and dental age assessment. In Kelley MA, Larsen CS. eds., Advances in dental anthropology. Wiley-Liss, New York, 143-168.

Stloukal M, Hanáková H (1978) Die Länge der Langsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Wachstumsfragen. Homo 29:53-69.

Suchey JM, Katz D (1998) Applications of pubic age determination in a forensic setting. In Reichs KJ, ed., Forensic Osteology: Advances in the Identification of Human Remains. Charles C. Thomas, Springfield. 204-236.

Ubelaker DH (1989) Human skeletal remains, excavation, analysis, interpretation. 2nd ed, Taraxacum, Washington.

Wood JW, Holman DJ, O'Connor KA, Ferrel RJ (2002) Mortality models for paleodemography. In Hoppa RD, Vaupel JW, eds., Paleodemography: Age Distributions From Skeletal Samples. Cambridge Studies In Biological And Evolutionary Anthropology 31. Cambridge University Press, Cambridge, 129-168.

Zoffmann KZ (2011) Kárpát-medence területéről származó neolitikus, réz-, bronz- és vaskori antropológiai sorozatok halandósági táblái (Life tables of anthropological series from the Neolithic, Copper, Bronze and Iron Ages from the Carpathian Basin). Folia Anthropol 10:17-58

Zoffmann KZ (2006) A bronzkori Füzesabonyi kultúra Polgár határában feltárt három temetőjének előzetes embertani ismertetése (A preliminary anthropological review of three cemeteries of the Füzesabony Culture explored near Polgár). DMÉ: 33-41.